PATENT SPECIFICATION

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COMPLETE SPECIFICATION

A Method of Winding Electric Machines

We, COMPAGNIE ELECTRO-MECANIQUE, of 12, rue Portalis, Paris (Seine Department), France, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Numerous difficulties are encountered in the automatic winding of the stators of small-power and medium-power electric machines whose coils are made of round wire if it is attempted to make the winding-machine imitate the winder's elaborate movements which besides will vary in the course of the winding operation and which are dependent on the reflexes of the operator.

This invention has for its purpose to remove these difficulties and is concerned with a winding method that will lead to the same results as hand-winding although it does not imitate its movements. The invention is based upon the fact that in the winding operation the longest and most costly step is the one by which the elements of the winding are inserted into the slots in the stator, and it principally aims at making this step automatic.

With this end in view, an intermediate step is resorted to in which the stator winding is prepared by arranging the said winding on a dummy rotor whose diameter is slightly less than the internal diameter of the stator to be wound. The stator and the dummy rotor have the same number of slots, and the shape and dimensions of the slots in the dummy rotor are only governed by the winding requirements of the latter.

This arrangement of the winding on the dummy rotor may be effected by hand while using pre-wound elements or mechanically by known methods. At that state of the winding operation the individual coils placed on the dummy rotor by one of the methods contemplated are interconnected.

The dummy rotor is then set in position within the stator and the two parts are centred with respect to each other with the aid of suitably shaped shims. The putting in its position of the stator winding is then effected by transferring the coils from the rotor slots into the corresponding slots in the stator. This operation is carried out at one time for the whole winding, after which it is only necessary to insert the stator slot wedges.

The coils can be transferred from the rotor slots into the stator slots in various ways.

In order that the invention can be understood more easily two methods of thus transferring the coils will now be described by way of non-limiting examples, with reference to the accompanying drawing.

A first method (figs. 1 and 2) consists in mechanically connecting the stator 1 with the coil-carrying dummy rotor 2 in such a manner that the apertures of the rotor slots 9 shall always remain in front of the apertures of the related stator slots and imparting a suitably chosen rotational speed to the whole. The centrifugal force to which the coil heads and the leads 3 are subjected tends to drive the latter towards the outside in the direction shown by the arrows in fig. 2. The coil heads are thus brought to their final positions in engagement with suitably designed stop wedges 4 which limit their displacement and which are secured to the stator laminations by suitable means known *per se*. The displacement of the leads can only take place through a channel delimited by the shims 5 arranged in the air-gap between two adjacent slots which shims moreover serve to keep the rotor in position with respect to the stator. By the effect of the centrifugal force the leads are whirled home into the slots in the stator in which they will be pressed together by this very centrifugal force tightly enough to ensure a satisfactory filling coefficient.

A further method (figs. 3 and 4) consists in resorting to the action of a taper drift

upon the coils through the medium of U-shaped shims. For that purpose the dummy rotor 2 is provided with a central bore 8. Cut through the bottom of each slot 9 in the rotor is a slot in which is slidably received the shank 6 of the push member 7 arranged in the bottom of said slot. All the shanks 6 project into the bore.

In the operation of transferring the winding the shanks 6 are acted on by a taper drift 8 whose axial displacement progressively drives the shims towards the periphery and thus shifts the leads from the rotor into the stator. The said taper drift may be so designed that after transferring the leads from the rotor into the stator it will expand out the coil heads into their ultimate position.

In order to prevent any mutual wedging of the leads as they are transferred from the rotor into the stator there may advantageously be provided, according to the invention, slight alternating displacements in both directions between the aforesaid two parts in order to contribute by a series of jerks to the easy transference of the leads.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A method of winding electric machine stators with round wire consisting in preparing separate winding elements arranging the said winding in slots provided in the periphery of a dummy rotor to match those in the stator, interconnecting the said winding elements, inserting the dummy rotor complete with winding 1 into the stator with the slots in the one in front of those in the other and driving the winding elements radially out of the slots in the dummy rotor into the stator slots.

2. A method according to Claim 1 wherein the dummy rotor once set in position within the stator is made rigid therewith and the whole is whirled at such a speed that the elements are driven by the centrifugal force out of the slots in the dummy rotor into the stator slots.

3. A method according to Claim 1 wherein each slot in the dummy rotor has a radially slidable member arranged therein which is adapted to drive into the corresponding stator slot the winding element present in the slot of the said dummy rotor, in combination with means to simultaneously move all the said slidable members outwardly from the centre of the said rotor.

4. A method according to Claim 1 wherein a series of jerks are applied to the dummy rotor and/or stator as the winding elements are transferred from the slots in the dummy rotor into the slots in the stator.

5. A device for preparing the winding of electric machine stators wherein an axial taper bore is provided in a cylindrical mandrel, the diameter of which is slightly less than the inner diameter of a stator and in the periphery of which longitudinal slots are cut to match the slots in the stator, the said taper bore being connected by radial slits with the peripheral slots, in combination with radially slidable members received in said slits and slots and with a taper drift movable axially in said taper bore and adapted to drive said slidable members radially away from the centre of the mandrel.

6. A device for the winding of electric machine stators according to Claim 5 in combination with shims to be inserted temporarily within the stator each between two successive slots for the purpose of guiding the winding elements as they are transferred from the slots in the dummy rotor into the slots in the stator.

Dated this 24th day of October, 1947.

MARKS & CLERK.

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Fig.1.

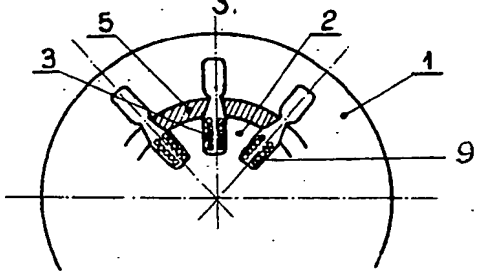


Fig.2.

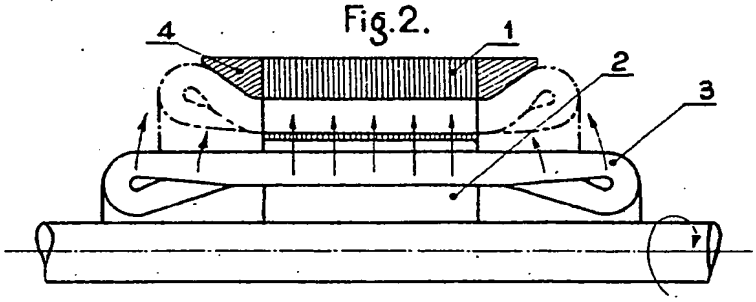


Fig.3.

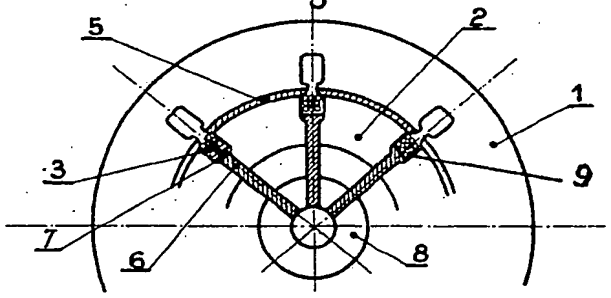
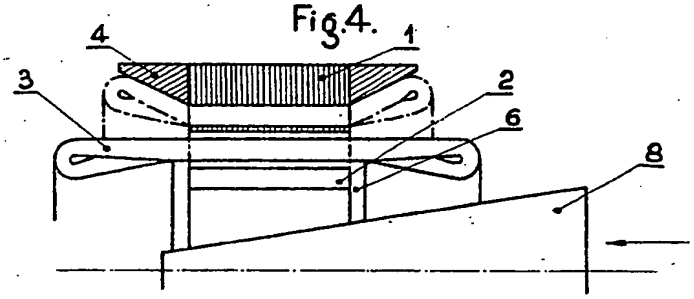


Fig.4.



[This Drawing is a reproduction of the Original on a reduced scale.]

H.M.S.O.(Ty.P.)

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